Sizing and Installing Culverts for Road Crossings

As required by Chapter 10 of the
Land Use Planning Commission's Rules and Standards

Maine Department of Agriculture, Conservation, and Forestry
Land Use Planning Commission

September 2020

Why: Culvert Size is important because *narrow culverts:*

- Increase the risk of damage, washouts, and flooding
- Lead to installing more culverts alongside
- Lose fill and riprap
- Cause logjams and sediment to block the inlet
- Block passage for fish and wildlife
- Degrade water quality
- Cause financial loss due to repairs and replacement

Proper sizing and installation of your culvert will benefit you, fish, and wildlife.

What: This guide can help you meet standards for culverts used in permanent stream crossings. Use it when building roadways across small streams.

Where: These standards apply in the townships, plantations, and towns served by Maine's Land Use Planning Commission.

When: Most stream crossings must be constructed between July 15 and September 30. Building a stream crossing between October 1 and July 14 requires prior approval from the Maine Department of Inland Fisheries and Wildlife.

Written notice of your proposed project must be sent to your regional LUPC office and the Army Corps of Engineers before beginning work. An LUPC permit is not needed if all the stream crossing standards in Section 10.27, D of the Commission's rules are met.

Please call the LUPC if you don't know whether your project is located in its service area, if you are unsure whether you are crossing a small stream (a "minor flowing water"), or if you are faced with a different road crossing situation.

*See **Contact Information** on page 7.*

Properly Sized and Embedded Culverts

Culvert spans the entire stream width, is embedded below grade, and contains streambed material.

Completed culvert showing streambed material (rocks and sediment) and riprap added.

Improperly Sized and Embedded Culverts

Culvert is too narrow causing pool at inlet. Water backs up during high flow, leading to erosion around culvert and washouts.

Narrow culverts become perched, preventing passage of fish and wildlife and backing up during high water events.

Culverts should be sized to handle a 25-year storm event, prevent perching and pooling, and let fish and wildlife pass normally.

LUPC standards require that culverts have a diameter at least 1.2 times the stream width and, once embedded, an opening for water at least 3 times the cross-sectional area of the stream.

Choosing the right culvert size requires measuring stream width and depth.

Measuring stream width and depth: One measurement of width and 3 evenly spaced measurements of depth are standard. But you may need more measurements if the stream channel varies.

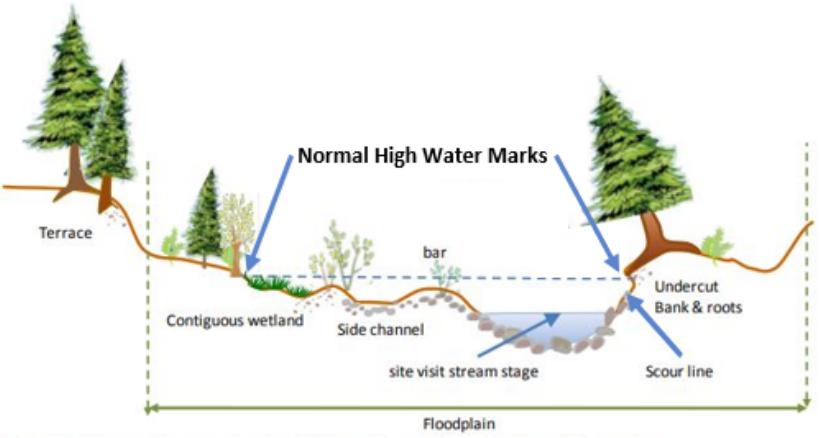
Take measurements where the culvert will be installed. If the area is not typical, find a more typical section nearby.

Measuring Stream Width

Stream width is measured level from the normal high water mark on one side to the normal high water mark on the other.

The normal high water mark is the line on the stream bank that separates the aquatic zone from the land zone.

The Normal High Water Mark



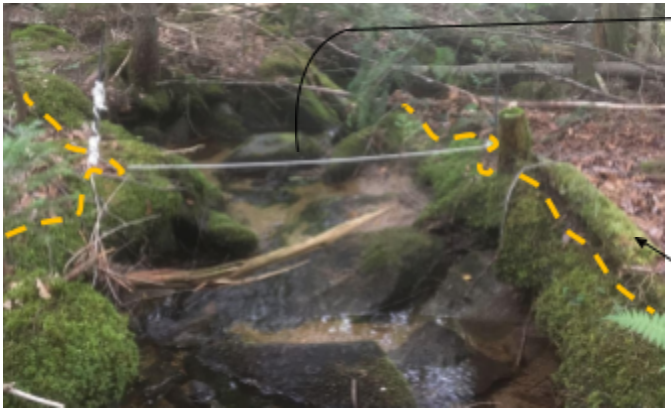
Clues for determining the normal high water mark:

-Change in soil appearance along the bank -Change in vegetation

-Change in slope of the stream bank

Tree roots, some non-aquatic plants, and moss can exist below the normal high water mark.

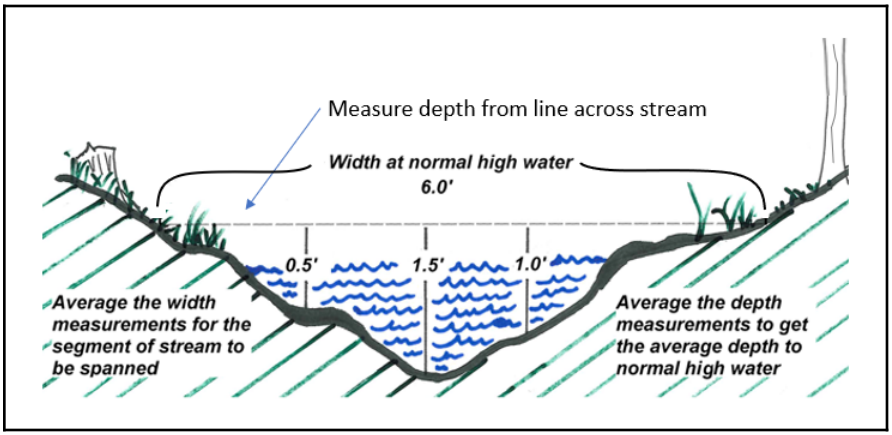
Look for the normal high water mark on both banks. If you cannot find the high water mark on one side, run a level line across from the high water mark on the other side.



The dashed line approximates the normal high water mark.

Measuring Stream Depth

Stream depth is measured from the line strung between the normal high water marks on either side. It is not measured on the existing water level. See the picture below.



Choosing the Culvert Size - The right size culvert:

- when embedded in the stream, will leave an opening at least 3 times the cross-sectional area of the stream

AND

- will have a diameter at least 1.2 times the stream width.

Step 1. Average your measurements of stream width and depth. Round width to the nearest foot, depth to the nearest half foot.

Step 2. Use the table below to find the standard round culvert diameter (in inches) that meets both the area and width requirements for the stream.

Sizing Guide for Round Culverts

Average Stream Width (feet)	Average Stream Depth (feet)			
	0.5	**1**	**1.5**	**2**
1	24	30	36	42
2	30	42	48	54
3	48	48	**60**	**66**[1]
4	**60**	**60**	**66**[1]	**84**
5	**72**	**72**	**72**	**84**
6	**90**[1]	**90**[1]	**90**[1]	**90**[1]

Minimum Culvert Diameter (in)

Shaded Opening Sizes: An arch culvert or bridge may be preferred on these larger streams.

[1]If 66 or 90 in. d… c… a… o… respectively.

See page 8 for helpful information on sizing non-circular culverts.

Additional Installation Standards:

- To the greatest extent practical, culvert installation must not disturb the stream's natural structure and work in the stream must be minimized.
- The culvert must follow the course and grade of the stream channel to the greatest extent possible.
- The slope of a year-round stream must be 2% or less (a 2.4 in. drop over 10 ft of stream bed) to use a culvert.

- The culvert should be seated on firm ground, compacted soil, or on geotextiles to stabilize the ground.
- For culverts 48 in. (4 ft) in diameter or less, a minimum of 1 foot of the diameter must be embedded below the streambed elevation. For culverts greater than 48 in. (4 ft) in diameter, a minimum of 25% of the culvert diameter must be embedded below the streambed elevation.
- For culverts greater than 60 in. (5 ft) in diameter, stream bed substrate must be added to the culvert bottom. For smaller culverts, rely on natural processes to fill the culvert bottom with sediment, sand, and gravel.
- The culvert should have soil compacted up the sides and be covered by soil to a minimum depth of 1 foot (or according to the manufacturer's specifications). The soil around each end should be stabilized to reasonably avoid erosion.

Be sure to check the crossing yearly for erosion and logjams.

*Send written notice to the appropriate LUPC regional office and to the Army Corps of Engineers office **BEFORE** beginning your project.*

Augusta Office 18 Elkins Lane 22 State House Station Augusta, ME 04333 Tel: (207) 287-2631 TTY: (888) 577-6690 FAX: (207) 287-7439	**Northern Region** 45 Radar Road Ashland, ME 04732 Tel: (207) 435-7969 FAX: (207) 435-7184
Downeast Region 106 Hogan Road, Suite 8 Bangor, ME 04401 (207) 215-4685 FAX: (207) 941-4222	**Eastern Region** 191 Main Street East Millinocket, ME 04430 (207) 485-8354
Moosehead Region 43 Lakeview Street P.O. Box 1107 Greenville, ME 04441 (207) 557-2874	**Western Region** 932 U.S. Route 2 East Wilton, ME 04294 (207) 670-7492
For More Information: maine.gov/dacf/lupc	

Army Corps of Engineers, Maine Project Office: (207) 623-8367
442 Civic Center Drive, Suite 350, Augusta, Maine 04330

Helpful Information for Sizing Non-Circular Culverts

Opening Size: The table below provides the total opening size needed for a culvert to provide 3 times the area of the stream channel once the culvert is embedded.

Sizing Guide for Culvert Openings

Average Stream Width (feet)	Average Stream Depth (feet)			
	0.5	**1**	**1.5**	**2**
1	3.1	4.8	6.5	8.2
2	4.8	8.2	11.4	14.9
3	6.5	11.4	16.8	22.4
4	8.2	14.9	22.4	29.9
5	9.8	18.7	28.0	37.3
6	11.4	22.4	33.5	44.8

Culvert Opening Size (sq. ft)

Diameter: The table below provides the culvert diameter corresponding to 1.2 times the average stream width.

Sizing Guide for Culvert Diameters

Average Stream Width (feet)	Culvert Diameter = 1.2X Average Stream Width (inches)
1	15
2	29
3	44
4	58
5	72
6	87

Best practices for culvert installation
"make the road invisible to the stream"

Credits: Figure on page 4 modified from Figures 3-11 in Publication 16-06-029, Washington State Department of Ecology. Used and modified with permission.